

Application No. 10/564,573
Office Action Dated: August 29, 2007
Amendment Dated: September 28, 2007

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously presented) An x-ray tube that injects an x-ray conebeam into an examination region, the x-ray tube including:
 - a rotating cylindrical anode having a target outer surface region, the cylindrical anode rotating about a longitudinally aligned cylinder axis;
 - a rotating helical-slot collimator that rotates around the cylindrical anode;
 - an electron accelerating means for accelerating electrons toward at least one selected spot on the target outer surface region of the cylindrical anode to generate x-rays; and
 - a sweep means for relatively longitudinally sweeping the at least one selected spot across the target outer surface region of the cylindrical anode in coordination with rotating the helical-slot collimator.
2. (Previously presented) The x-ray tube as set forth in claim 1, wherein the cylindrical anode includes:
 - a central supporting cylinder; and
 - a metallic layer at least a portion of which defines the target outer surface region.
3. (Previously presented) The x-ray tube as set forth in claim 2, wherein the central supporting cylinder includes:
 - an outer shell defining a hollow cylinder core; and
 - at least one structural support member disposed in the hollow cylinder core, the at least one structural support member mechanically coupled to an associated rotating shaft.
4. (Previously presented) The x-ray tube as set forth in claim 2, wherein the metallic layer is a tungsten coating.

5. (Previously presented) The x-ray tube as set forth in claim 1, wherein the cylindrical anode includes:

a substantially solid metallic cylinder, at least a portion of an outer surface of said solid metallic cylinder defining the target outer surface region of the cylindrical anode.

6. (Previously presented) The x-ray tube as set forth in claim 1, wherein the cylindrical anode includes:

a substantially hollow outer cylindrical shell; and

at least one structural support member disposed in the substantially hollow outer cylindrical shell, the at least one structural support member mechanically coupled to an associated rotating shaft.

7. (Previously presented) The x-ray tube as set forth in claim 1, wherein the accelerated electrons define an electron beam, and the sweep means includes:

an electron deflector that selectively deflects the electron beam to sweep the at least one selected spot across the target outer surface region of the cylindrical anode.

8. (Previously presented) The x-ray tube as set forth in claim 7, wherein the helical-slot collimator has a helical collimating slot formed therein, surrounds the rotating cylindrical anode, and rotates about a collimator axis parallel to the cylinder axis, and a helical pitch of the helical collimating slot and a rotation rate of the collimator, relative to the sweep of the at least one selected spot, are such that the at least one selected spot coincides with the helical-slot during the sweeping.

9. (Previously presented) The x-ray tube as set forth in claim 8, further including: an evacuated frame that surrounds the rotating cylindrical anode, the rotating cylindrical helical-slot collimator being arranged outside of the evacuated frame.

10. (Previously presented) The x-ray tube as set forth in claim 8, wherein the rotating cylindrical helical-slot collimator includes:

an outer cylindrical shell surrounding the rotating cylindrical anode and aligned with the collimator axis, the outer cylindrical shell having a first helical slot defined therein; and

an inner cylindrical shell surrounding the rotating cylindrical anode and disposed inside the outer cylindrical shell, the inner cylindrical shell being aligned with the collimator axis and having a second helical slot defined therein that aligns with the first helical slot, the first and second helical slots cooperatively defining the helical collimating slot.

11. (Previously presented) The x-ray tube as set forth in claim 10, wherein the outer and inner cylindrical shells are secured together and rotate as a unit.

12. (Previously presented) The x-ray tube as set forth in claim 8, further including:

a fixed axially limiting collimator that axially limits the x-rays.

13. (Previously presented) The x-ray tube as set forth in claim 1, wherein the sweep means includes:

a longitudinal reciprocating mechanism longitudinally reciprocating the cylindrical anode to effect a longitudinal reciprocating sweep of the at least one selected spot across the target outer surface region of the cylindrical anode.

14. (Currently amended) A CT scanner including:

a rotating gantry which rotates around an examination region and an axis of revolution;

an x-ray tube being mounted to the rotating gantry with the cylinder axis parallel to the axis of revolution, wherein the x-ray tube includes:

a rotating cylindrical anode having a target outer surface region, the cylindrical anode adapted to rotate about a longitudinally aligned cylinder axis;

an electron accelerator adapted to accelerate a beam of electrons toward at least one selected spot on the target outer surface region of the cylindrical anode to generate x-rays;

a focal spot positioning component for relatively longitudinally sweeping the at least one selected spot across the target outer surface region of the cylindrical anode; and

a cylindrical helical-slot collimator, surrounding the rotating cylindrical anode, adapted to collimate the generated x-rays as the spot sweeps across the target;

an x-ray detector arranged to detect x-rays after the x-rays pass through the examination region; and

a reconstruction processor for reconstructing output signals from the x-ray detector into an image representation.

15. (Currently amended) The CT scanner computed tomography imaging system as set forth in claim 14, further including:

a synchronization circuit that synchronizes the sweep with rotation of the rotating gantry.

16. (Currently amended) The CT scanner computed tomography imaging system as set forth in claim 14, wherein the cylindrical helical-slot collimator has a helical collimating slot formed therein and rotates about a collimator axis that is parallel to the cylinder axis, a helical pitch of the helical collimating slot and a rotation rate of the collimator being selected relative to the sweep of the at least one selected spot such that the at least one selected spot coincides with the helical-slot during the sweeping.

17. (Previously presented) A method of generating x-rays including:

rotating a cylindrical anode about a cylinder axis, the cylindrical anode having a cylindrical target outer surface region;

rotating a helical-slot collimator around a collimator axis that is parallel to the cylinder axis;

accelerating electrons toward at least one selected spot on the target outer surface region of the cylindrical anode to generate x-rays; and

relatively sweeping the at least one selected spot continuously across the target outer surface region of the cylindrical anode along a beam trajectory substantially parallel to the cylinder axis and in coordination with rotating the helical-slot collimator.

18. (Previously presented) The method as set forth in claim 17, wherein the relative sweeping includes:

steering at least one electron beam defined by the accelerated electrons longitudinally across the cylindrical anode.

19. (Currently amended) The method as set forth in claim [[17]] 18, wherein the relative sweeping includes:

fast-retracing the at least one electron beam to return to a longitudinal sweep starting point subsequent after each longitudinal sweep across the cylindrical anode.

20. (Previously presented) The method as set forth in claim 17, wherein the relative sweeping includes:

longitudinally reciprocating the cylindrical anode to effect longitudinal reciprocating sweeping of the at least one selected spot on the target outer surface region of the cylindrical anode.

21. (Cancelled)

22. (Previously presented) The method as set forth in claim 17 wherein the collimator axis corresponds to the beam trajectory.

23. (Previously presented) The method as set forth in claim 17 wherein the at least one selected spot includes a plurality of spots separated by a helical pitch of a helical slot of the helical-slot collimator that generate a corresponding plurality of x-ray beams.

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24. (Previously presented) The method as set forth in claim 17, further including:
- rotating the cylindrical anode around an axis of rotation, the axis of rotation being parallel to the cylindrical axis;
- sweeping the at least one selected spot in coordination with the rotating;
- detecting the x-rays which have passed through a subject along the axis of rotation;
- converting the detected x-rays into an image of the subject.
25. (Currently amended) An x-ray tube, comprising:
- a rotating cylindrical anode;
- an electron accelerator that accelerates electrons toward a region on the surface of the cylindrical anode to produce a focal spot; and
- an anode positioner that selectively positions the cylindrical anode longitudinally with respect to the electron accelerator, and
- a cylindrical helical-slot collimator adapted to collimate a radiation beam emitted from the focal spot.
26. (Previously presented) The x-ray tube of claim 25, wherein the anode positioner reciprocates the cylindrical anode to sweep the accelerated electrons back and forth along the anode and, thereby, sweep the focal spot back and forth along the anode.
27. (Cancelled)
28. (Currently amended) The x-ray tube of claim [[27]] 25, wherein the cylindrical helical-slot collimator surrounds the cylindrical anode and rotates about a collimator axis that is parallel to [[the]] a cylinder axis.
29. (Currently amended) The ~~radiation source~~ x-ray tube of claim 25, wherein the x-ray tube ~~radiation source~~ is part of a computed tomography system.